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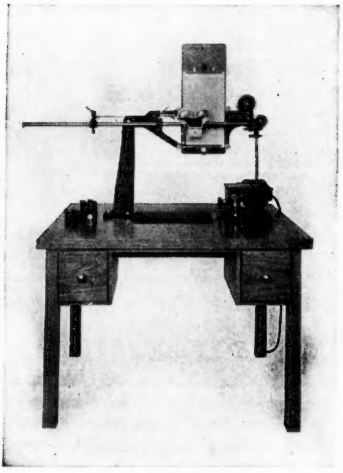

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The Editor's Page

New Research Council Heads

THE RESIGNATION of Warren E. Emley as chairman of the Institute's Research Council, and of Dr. H. DeW. Smith as vice-chairman, have been regretfully accepted, and President Killheffer has appointed as acting-chairman W. D. Appel, Chief, Textile Section, National Bureau of Standards, and as vice-chairman Edward R. Schwarz, Professor of Textile Engineering, in charge textile research, Massachusetts Institute of Technology. Mr. Appel's appointment as "acting-chairman" pending the next meeting of the Board of Directors is made necessary by the by-laws which provide that the chairman of the Council must be a director and a member of the executive committee and shall be elected by the Board.

Both Mr. Appel and Prof. Schwarz have been members of the Institute since its organization in 1930, and the latter is a director, a member of the executive committee and a vice-president.

Dr. Smith's resignation was tendered at the last annual meeting and was, he stated, "only one of many association activities that he would be obliged to give up in order to prevent their encroachment upon his increasing business duties." He has been one of the Institute's most active members as a director, a member of the executive committee, vice-chairman of the Research Council, and a member of special committees. That his interest in Institute work is unabated is indicated by transfer from annual to contributing membership.

Warren E. Emley is not only an original member of the Institute, but took an active part in its organization. The conferences on textile research that he had promoted and conducted at the National Bureau of Standards for several years prior to 1930 had indicated the need of a textile research body, and undoubtedly aided the Institute's organization. As the first chairman of the Research Council he and the Institute's first president, the late Dr. Samuel W. Stratton, with whom he had been associated when the latter was director of the National Bureau of Standards, had the responsibility of planning the Institute's research methods and program, and the basic soundness of the latter is indicated by the fact that they have changed but little since then. The research accomplishments of the Institute have been due largely to Mr. Emley's basic scientific knowledge and to his administrative ability. His belief that future research activities of the Institute will be more of an applied than of a basic nature, and that the Council should be headed by men more intimately acquainted with mill practice were some of the reasons that he gave for resigning a position that he has filled with such distinction for more than eight years. He maintains his membership and interest in the organization's work, and as his successor, Mr. Appel, is associated with him at the Bureau of Standards, he may be expected to have the benefit of his experience in Institute work when needed.

Practical Application of Research

RESULTS of a fundamental research of the Textile Foundation have had practical application in the municipal sewage plant recently completed at Greensboro, N. C., at a cost of about one million dollars. Greensboro's sewage problem was complicated, as is that of many textile communities, by the necessity of handling a relatively large quantity of wastes from textile mills and their dyeing and finishing plants. The proper handling of most of the latter complications had been indicated by the Textile Foundation research. This study has been in progress at the University of North Carolina, and at a pilot plant in Greensboro since the Fall of 1932. The research has been wholly financed by the Textile Foundation, and to date four reports have been published in TEXTILE RESEARCH under the general title "The Disposal and Recovery of Textile Waste Liquors," and eight under the title "Fundamental Properties of Textile Wastes." The work at the University of North Carolina has been conducted under the direction of Dr. H. G. Baity, Professor of Sanitary Engineering, latterly with the aid of Dr. Frank K. Cameron, Professor of Chemistry, and some seven associates. Because of the pending Federal legislation designed to control stream pollution, and the importance of the Greensboro sewage plant as a practical application of research, Dr. Baity will present in an early issue of TEXTILE RESEARCH a description of the plant and the cooperative plan by which it was constructed and is conducted by the city and its industries.

* * *

Committee D-13's Research on Textile Finishes

THE RESEARCH program of the Special Committee for Testing of Textile Finishes of Committee D–13 of the A. S. T. M., will be carried out by its own research associate at the National Bureau of Standards and will emphasize methods for the physical evaluation of the handle of textiles, and include test methods for certain other types of textile finishes. As a directing committee for this research there was appointed at a meeting held in New York City Feb. 21 the following: L. B. Arnold, Jr., research chemist, E. I. du Pont de Nemours & Co., technical laboratory, chairman; Miss Elizabeth Weirick, in charge testing laboratories, Sears, Roebuck & Co.; Prof. H. J. Ball, Lowell Textile Institute, and chairman of Committee D–13. Members who will act in an advisory capacity are W. D. Appel, Chief, Textile Section, National Bureau of Standards, and K. H. Barnard, chief chemist, Pacific Mills Print Works Div.

* * *

Color Tolerances Discussed

COLOR TOLERANCES was the subject of a series of papers presented at a meeting held in New York City Feb. 23 under the joint sponsorship of the Inter-Society Color Council and the American Psychological Association. Papers were presented on the following subjects: The Physics of Color Tolerance, by Deane B. Judd, National Bureau of Standards; Psychophysics of Tolerances, by Edwin G. Boring, Harvard University;

Ratio Method in the Review of the Munsell Colors, by Sidney M. Newhall, Johns Hopkins University; Color Tolerances as Affected by Changes in Composition and Intensity of Illumination and Reflectance of Background, by Harry Helson, Bryn Mawr College; Representation of Color Tolerances on the Chromaticity Diagram, by David L. MacAdam, Eastman Kodak Co.; Specification of Color Tolerances at the National Bureau of Standards, by Deane B. Judd, National Bureau of Standards; Industrial Color Tolerances, by Isay Balinkin, University of Cincinnati. A feature of the evening session was termed a "parade of color," at which recent color developments and research projects were demonstrated in a popular manner. Color in textiles was illustrated by an exhibit prepared by W. D. Appel, Chief, Textile Section, National Bureau of Standards.

* * *

Federation of Canadian Textile Technical Associations

THE Federation of Textile Technical Associations of Canada was organized at a meeting in Hamilton, Ont., Feb. 4. According to the *Canadian Textile Journal* the Federation includes the entire membership of the Canadian Association of Textile Colourists and Chemists and the Textile Society of Canada. Provision is made in the constitution for additions to this membership from employers' and other organizations. Objectives are to promote and co-ordinate the interests and efforts of members, particularly in regard to textile education, standards, research, publicity and related matters. Provisional officers are E. P. Carney, of the C. A. T. C. C., president, and P. W. Webb, secretary. The next meeting will be held in Montreal in April. Although not mentioned in the news report the Federation appears to embody some of the ideas suggested by Frank Nasmith, president of The Textile Institute, Manchester, Eng., at the dinner tendered to him last May by the Textile Society of Canada.

* * *

Science and Empiricism

Cellulosic fibres are said to acquire approximately the same degree of affinity as wool for ordinary acid dyes when they have been treated with compounds of chromium, iron, cobalt, nickel, molybdenum, vanadium, tungsten or copper, and the latter fixed by means of an "animalizing" agent, other than protein substances.

* * *

Before her broiled live lobster is served, your night club companion may be interested to know that the red dyes in the hypodermis of the lobster are esters of astaxanthin and not of astacin as formerly believed, and give, on hydrolysis in absence of air, the characteristic deeply colored enol salts, readily autoxidized to the tetraketone, and that it is probable that all dyes contained in shell fish are derivatives of astaxanthin.

"Rubberizing" of wool fabrics with diluted rubber latex, so that air permeability is retained and also the characteristic properties of the wool fibre, are reported the objectives of a study of the British Research Association for the Wool Industries. The rubber is not present as a continuous film, but as a fibre coating. The treatment is said to increase fabric strength and resistance to milling and to abrasive wear.

* * *

The "Sanitized" fabric process developed by the United Piece Dye Works should not only be a boon to the poor working girl with a limited wardrobe, but might justify a law to enforce its general use. As applied to silks, rayons, cottons and linens it eliminates "B. O.", and is said to withstand dry cleaning, and be replacable in laundering. "Sanitizing" is designed to make fabrics self-sterilizing and actively antiseptic, and to prevent the growth of the bacteria which are responsible for the decomposition of perspiration residue and its change from acid to alkaline with the latter's characteristic "B. O.."

* * *

Golf club shafts made of cotton, jute or other suitable cellulose fibre, impregnated with phenol-formaldehyde resin and reinforced with metal, have been developed and patented by a Scotch inventor. It is claimed that they combine all of the desirable features of wooden and steel shafts minus their disadvantages. Reference to comparative cost presumably is considered unnecessary.

* * *

Sylex yarns as described in a recent issue of *Silk and Rayon* "are lustrous as satin, fine as silk, soft as swansdown, durable as linen, absorbent as wool, and exceptionally strong." Fabrics woven thereof retain all of the properties of the yarns, are unshrinkable, impervious to the effects of perspiration and body acids, resistant to the effect of laundering and abrasive wear for an almost indefinite period, and are not made of synthetic fibres. Sylex yarns are spun from West Indian Sea Island cotton by the Fine Cotton Spinners' and Doublers' Association, Manchester, Eng. In this synthetic textile age this may be news to some textile men.

* * *

Neophil is a sewing thread made of Nylon, the new synthetic yarn developed by E. I. du Pont de Nemours & Co. It is being made and marketed by the Premier Thread Co., Pawtucket, R. I., for a variety of uses for which it is specially adapted. It is available in 2- and 3-cords and in a wide variety of colors of high fastness to washing and light. Neophil is said to be the first textile product made in commercial quantities from Nylon.

* * *

Red flannel, made in Huddersfield, Eng., of fine lamb's wool and medicated by a patented process, is claimed "to possess unusual healing properties for rheumatism and similar ailments." According to the Lon-

(*Continued on page 191.*)

Silk Wax and Certain Physical Properties of Raw Silk

By WERNER BERGMANN *

A Textile Foundation Publication

Summary

The ether-soluble fraction of a series of samples of raw silk has been determined. It has been expressed in terms of the E. S. No., which designates the number of milligrams of ether-soluble material obtainable from a 10 g. sample of silk. The E. S. Numbers of the silks which have been investigated fall between 30 and 100. The average E. S. No. is 55.

There exists no apparent relation between the E. S. No. and the nature, boil-off, tenacity, elongation, cohesion and resistance to friction of raw silk.

The wetting properties of raw and dewaxed silk have been compared by means of the sinking test. It was found that in general removal of the wax reduces the sinking time from many seconds or even several minutes to a fraction of a second.

Introduction

DURING the past years the author has been engaged in a systematic study [1-6] of the role played by certain lipoids during the life cycle of the silk worm, "Bombyx mori." Included in these investigations was a comparative study of the composition and biological significance of wax-like substances found in the various phases of the life cycle of the insect. It has been shown in previous communications by the author that these waxes consist mainly of a mixture of hydrocarbons of the probable order $C_{25} - C_{31}$ and of esters of alcohols and acids of the probable order $C_{26} - C_{32}$. It has been emphasized that the principal properties of waxes of such composition are their resistance against chemical action and their water repellancy.

It has not yet been definitely decided whether the waxes under discussion are synthetized by the life processes of the insect itself or whether they derive from the mulberry leaf which constitutes the exclusive diet of the worm. It was found that the shiny waxy surface layer of the mulberry leaf contains the same components as are found in the waxes secreted by the insect. Since the worm consumes considerable quantities of the leaf wax along with the leaf the assumption appears to be justified that the

* Senior Research Fellow of the Textile Foundation (1938–39) operating in the Sterling Chemistry Laboratory of Yale University under the direction of Prof. T. B. Johnson.

worm utilizes part of the leaf wax in order to satisfy its own wax requirements.

Part of the wax resorbed by the worm is utilized for the preparation of "cuticulin." This interesting material which has recently [5] been isolated and analyzed by the author forms the principal component of the epicuticle, an extremely thin film which covers the cuticle or skin of the worm and confers upon it its characteristic impermeability. Another part of the wax is stored by the worm and passed on to the chrysalis from which it can be extracted along with the chrysalis oil.[1] The wax stored in the chrysalis is utilized later for the formation of the epicuticular substances of the moth, and in case of the female insect also to furnish the wax-like substances which contribute to the characteristic impermeability of the shells of the insect eggs.

A third part of the leaf wax resorbed by the worm is used for the preparation of the silk wax which is added to the silk for the purpose of increasing its resistance against excessive humidity as well as desiccation.[5] The author has made the significant observation [4] that the silk fibres which form the outside layers of the cocoon contain the highest concentration of wax. It is here where the protective action of the wax against the adversities of the climate are most desired.

The total amount of leaf wax consumed by the worm during its lifetime is much greater than its possible requirements for the formation of the waxes under discussion. Consequently, considerable quantities of leaf wax are not utilized and excreted with the droppings.

The study of the role played by the waxes in the life cycle of the silkworm (see Fig. 1) serves as an interesting illustration of their biological

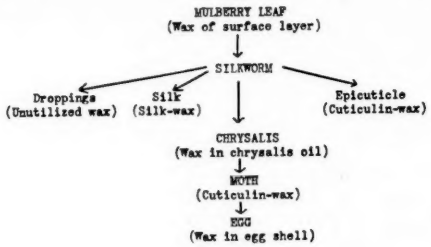

FIG. 1.

significance. The importance of the waxes lies in the impermeability which they confer upon the underlying layers of organic matter, which can consist of cellulose as in the leaf, of chitinous substances as in the worm and moth, of keratinous material as in the egg, and of protein as in the silk fibre.

Silk Wax and Certain Physical Properties of Raw Silk

In a previous investigation it has been found that raw silk contains 0.54% of ether-soluble, wax-like material. This figure was based on the amount of substance isolated by means of alcohol-ether extraction from a

large quantity of mixed lots of white Chinese silk. It can therefore be regarded only as an average value. Quantitative determinations of the ether-soluble fraction have now been carried out on a series of individual lots of known properties. It must be emphasized here that, in addition to the wax, the ether extracts of raw silk often contain small amounts of oily or fatty materials, and that consequently the terms wax and ether-soluble fraction are not strictly equivalent. In order to avoid confusion it has therefore been decided to express the amount of ether-soluble material obtainable from raw silk in terms of the E. S. No. This "ether-soluble number" stands for the number of milligrams of ether-soluble material present in a 10 g. sample of raw silk.

In the first series the E. S. Numbers of 19 lots of white Japanese silk were determined. (See Table 1.) It was found that the numbers of 77% of all the lots fell between 40 and 60. Only lot 10 had a lower number, and lots 2, 7, 13 and 19 had high numbers between 70 and 90. The average E. S. No. of all lots was 55. There are no apparent relations between the E. S. Numbers, the amounts of boil-off and the "nature" of the various samples. (See Table 1.)

TABLE 1

Comparison of the E. S. No. of Various Samples of White Japanese Silk

Sample	Denier	Boil-off	Nature	E. S. No. (average)	E. S. No. (variations)
1	13/15	—	hard	49	48.4–50.5
2	20/22	—	medium	88	86.9–89.0
3	13/15	19.04%	hard	55	53.5–57.6
4	13/15	21.24%	hard	53.5	53.0–54.0
5	13/15	19.77%	very hard	38	36.2–39.2
6	13/15	21.97%	hard	52	51.0–53.0
7	13/15	19.97%	hard	86	82.3–89.0
8	13/15	20.98%	hard	53	53.3
9	13/15	18.71%	very hard	51.5	51.2–52.8
10	13/15	19.21%	hard	57	54.5–65.6
11	13/15	21.48%	hard	50	47.0–53.1
12	13/15	19.91%	hard	43	42.8–43.0
13	13/15	20.44%	very hard	72	68.4–74.3
14	13/15	21.07%	very hard	46	45.2–46.7
15	19/20	20.68%	hard	54	52.1–54.4
16	—	—	—	51	50.0–51.0
17	—	—	—	48	47.0–49.0
18	20/22	—	—	47	46.5–47.5
19	20/22	—	—	74	73.0–74.5

In a second series the E. S. Numbers of silks of different origin were determined. The yellow silks, lots 25, 26 and 27, whether of Japanese or Italian origin were found to give high numbers between 90 and 100. It must be taken into consideration, however, that the ether extracts of colored silks contain pigments in addition to the wax. The average E. S. No. of white Chinese silks was about the same as that of white Japanese silks. In Table 2 the E. S. No. is compared with the tenacity, elongation, cohesion

TABLE 2

Comparison of the E. S. No. and Physical Properties of Various Samples of Raw Silk

Sample	Origin	Denier	Tenacity	Elongation in %	Cohesion. No. of strokes	Resistance to friction	E. S. No. (avg.)	E. S. No. (variations)
18	Japan	20/22	3.80	21.3	100% 195	521 poor	47	46.5–47.5
19	Japan	20/22	3.65	23.4	100% 147	751 good	74	73–74.5
20	China	20/22	3.68	20.9	88% 104	2911 excell.	45	42–48
21	China	13/15	3.73	22.3	92% 79	1020 excell.	41	38–45
22	China	20/22	3.72	21.7	93% 121	958 very good	60	50–62
23	Canton	14/16	3.08	19.8	78% 47	185 very poor	33	32–35
24	Canton	20/22	2.97	21.0	65% 18	955 excell.	75	71–80
25*	Italy	20/22	3.51	24.8	75% 56	1825 excell.	97	95–99
26*	Japan	20/22	3.55	23.5	88% 103	950 very good	98	94–102
27*	Japan	20/22	3.64	23.9	100% 162	566 poor	95	90–100

* Yellow silks.

and resistance to friction of the various samples. It can be readily seen that there exists no relation either between the various physical properties or between any of them and the E. S. No.

Silk Wax and the Wetting Properties of Raw Silk

It has been stated in the introduction to this report that the silkworm adds wax-like material to the silk for the principal purpose of increasing its resistance against excessive humidity as well as desiccation. Because of this treatment raw silk may be considered as a fibre which has been "waterproofed." It has been the purpose of this part of the investigation to obtain some information concerning the degree of influence exerted by the silk wax on the wettability of raw silk. This was achieved by a comparative study of the wetting properties of silk before and after the removal of the wax. After several preliminary experiments the "sinking test" was selected as the most suitable method for the determination of the wetability of the various samples. This test, which was devised by Draves, has been accepted as an official test for the evaluation of wetting agents by the American Association of Textile Chemists and Colorists.[7] Since it was found that the sinking time of most samples of silk was too long in distilled water all tests were carried out in an aqueous solution of 0.05% Tergitol 7.

The data obtained for the average sinking times of 14 selected lots of silk are shown in column 1 of Table 3. The samples of white Japanese silk wetted out much faster than those of any other type with the possible exemption of white Chinese silk. The Canton and yellow silks did not sink inside of three minutes, and their sinking times were consequently classified as 180 + seconds. The samples which had been used in the first series of determinations were rinsed with cold water dried in a stream of

hot air and then subjected to a second test. The average sinking times observed in this second series are shown in column 2 of Table 3. They do not differ greatly from the values obtained in the first series.

TABLE 3

Comparison of the Wetability of Raw and Dewaxed Silks in 0.05% Tergitol 7

Sample	Origin	Raw Silk		Dewaxed Silk		E. S. No.
		1st test	2nd test	1st test	2nd test	
		(Average time of sinking in seconds)				
13	Japan	18.6	40	0–2	18	72
15	Japan	33	42	0–1	3	54
16	Japan	51	65	0–1	3.5	51
17	Japan	48	78	0–1	2–3	48
18	Japan	80	76	0–1	9	47
19	Japan	150	175	0–4	10	74
20	China	160	135	0–1	15	45
21	China	180+	180+	0–1	15	41
22	China	180+	180+	0–1	3–4	60
23	Canton	180+	180+	1	10	33
24	Canton	180+	180+	13	20	75
25	Italy	180+	180+	0–1	12	97
26	Japan	180+	180+	0–1	8	98
27	Japan	180+	180+	0–1	15	95

On comparing the average sinking time of the various samples with their E. S. No., one can readily see that the absolute magnitude of the wax content does not influence the wetability of a sample. Sample 13, for instance, which has a high E. S. No., wets out faster than sample 18, with a low E. S. No. These findings are not very surprising because it can be easily visualized that it is not the absolute amount of wax present in raw silk which determines the degree of wetability but rather the evenness with which the wax is distributed along the surface of the fibre. It is obvious that a fibre containing only a small but evenly distributed amount of wax is better protected against water than a fibre containing large but erratically distributed amounts of wax.

In a parallel set of experiments the sinking times of dewaxed samples were determined. With the exception of sample 24 (see column 3 of Table 3), the average sinking times of all skeins were below 1 second. Most skeins sank practically instantaneously. As in the case of raw silk the samples used in the first series of tests were rinsed, dried and retested. The average sinking times of the second series of tests (see column 4 of Table 3) were found to be from 2–20 seconds higher than those of the first series. This increase in time was very likely due to the fact that the rinsed and dried samples were not as "loose" as previously. The treatment with tergitol and water had apparently brought about a softening of the sericin which made the fibres stick together more closely, and prevented a rapid escape of enclosed air during sinking.

A comparison of the sinking times of the various samples before and after the removal of wax demonstrates quite convincingly the significant influence exerted by the wax on the wetting properties of silk. The results point out that in choosing wetting agents for raw silk, such substances should be given preference which are known to possess wax penetrating properties.

Analytical Part

All determinations which are discussed in this report were carried out on one or more of 5 g. skeins of silk specially prepared for this investigation. The author wishes to express his gratitude to the Cheney Brothers at South Manchester, Conn., the United States Testing Co. at Hoboken, N. J., and the Grove Silk Co. at Scranton, Pa., for their generous help in supplying the needed material.

A. The Determination of Wax.—Four 5 g. skeins were dried to constant weight, loosened slightly, placed into a 1000 cc. Erlenmeyer flask and covered with 500 cc. of 80% ethyl alcohol. A simple glass condenser was then hung into the neck of the flask, and the liquid was kept boiling gently for 15 hours. The hot extract was then poured through a large funnel into a round bottom flask fitted with a ground joint. The Erlenmeyer flask was held for 15 minutes over the funnel in such a manner as to permit most of the alcohol adherent to the silk to run into the round bottom flask. After silk and funnel had been rinsed with a little alcohol, the silk was boiled with 500 cc. of 95% alcohol for five hours. The second extract was also transferred into the round bottom flask along with the rinsings, and the combined extracts were then concentrated in an all glass still. The concentration was interrupted when the remaining liquid was less than 100 cc. in volume or when it had become very opaque because of the separation of wax.

In the meantime, the silk was transferred into an all glass Soxhlet apparatus and extracted for five hours with ether. The milky liquid obtained on concentration of the alcoholic extracts was transferred into a 250 cc. Erlenmeyer flask. The round bottom flask, which still contained small quantities of wax adhering to the wall, was first washed several times with small quantities of the ether of the Soxhlet extraction and then with fresh ether. Ether-extracts as well as washings were then transferred into the 250 cc. Erlenmeyer flask. In case more ether had been used than could be comfortably placed into the 250 cc. flask, it was first concentrated to a suitable volume. The combined extracts were then evaporated to dryness on a water bath and the residue dried at 105°.

The residue consisted of a mixture of ether soluble and insoluble substances. It was treated repeatedly with small amounts of boiling ether. The brown ether extracts were filtered through a small funnel into an accurately weighed 50 cc. flask. This flask was heated on a steambath during the entire procedure in order to permit a constant concentration of the extracts. Extractions and rinsings of the 250 cc. flask and the filter-paper were continued until all ether soluble material had been transferred to the 50 cc. flask. The extracts were then evaporated to dryness, and the flask was dried at 105° to constant weight.

Example. Two samples of four skeins each of lot 25 (Italy Y. B. Cheney) weighed 20.88 and 20.14 g. They gave 0.1985 and 0.1995 g. of

ether soluble material. The amount of extract was therefore 0.95 and 0.99%, and the E. S. No. 95 and 99.

In many instances determinations were carried out on a series of samples including single skeins. This was done in order to establish the degree of variation of extractable material in an individual lot.

Example. Lot 3 (Japan White, United States Testing Co.).

Weight of sample	Number of skeins	Weight of extract	% of total	Deviation from average
31.0100g	4	0.1120g	0.362	− 4.3%
30.9780g	4	0.1182g	0.381	+ 0.8%
6.7313g	1	0.0247g	0.367	− 3.0%
7.0000g	1	0.0306g	0.437	+15.9%
5.1890g	1	0.0217g	0.418	+10.8%
5.4270g	1	0.0189g	0.348	− 8.1%

Occasionally the deviations from the average were quite considerable, especially among the values obtained on single skeins.

Example. Lot 6 (Japan White, United States Testing Co.).

Weight of sample	Number of skeins	Weight of extract	% of total	Deviation from average
21.7300g	4	0.1939	0.890	+ 3.1%
5.1730g	1	0.0632	0.810	− 6.1%
5.5680g	1	0.0632	1.135	+31.5%
4.7912g	1	0.0346	0.705	−18.3%
5.8332g	1	0.0440	0.754	−12.6%
4.5838g	1	0.0367	0.800	− 7.3%
5.6190g	1	0.0438	0.780	− 9.6%
5.6224g	1	0.0411	0.748	−11.9%
4.6904g	1	0.0452	0.963	+10.4%

B. The Determination of the Wetting Properties of Raw and Dewaxed Silk.—The wetting properties of the various samples were determined by Draves' sinking test. This test consists in measuring the time required for a 5 g. skein connected with an anchor and sinker to sink in water containing a wetting agent. For the determination of the sinking time a 5 g. skein of silk was folded once. The anchor with the sinker was then fastened at one end of the folded skein and the latter cut through at the end opposite the sinker. The cut end of the skein was loosened up and the skein with the sinker and anchor hanging at the bottom dropped into a 1000 cc. cylinder containing an aqueous solution of 0.05% Tergitol 7. The time elapsing between the entering of the skein and the moment when the thread connecting sinker and anchor began to slacken was measured with a stop watch. Comparative determinations were always carried out at the same temperature.

Example. Lot 15 (Japan White, Grove Silk Co.).

The sinking time of 9 raw skeins was 18, 60, 15, 10, 40, 15, 40 and 65 seconds or an average of 33 seconds. The same samples after rinsing with cold water and drying in a stream of hot air sank in 35, 30, 45, 75, 20, 55, 30 and 50 seconds or an average of 42 seconds. All dewaxed samples of the same lot sank in less than one second. After rinsing and drying they sank in 2, 3, 4, 4, 2 and 4 seconds or an average of 3 seconds.

Example. Lot 20 (China White, Cheney Silk).

Sinking times of raw silk. First test: 100, 180, 240, 90 and 200 seconds or an average of 160 seconds. Second test: 180, 100, 160, 90 and 140 seconds or an average of 135 seconds.

Dewaxed silk. First test: all below one second. Second test: 20, 15, 10 and 25 seconds or an average of 15 seconds.

Example. Lot 22 (China White, Cheney Silk).

Sinking times of raw silk. First test: 180 +, 180 +, 50, 180 + and 180 + seconds or an average of 180 + seconds. Second test: 180 +, 180 +, 47, 180 +, and 180 + seconds or an average of 180 + seconds.

Dewaxed silk. First test: all below one second. Second test: 2, 3, 5, and 3 seconds or an average of 3–4 seconds.

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"RESEARCH, unfortunately, is regarded in some quarters as 'trouble shooting.' There is sometimes a tendency to put the cost down entirely on the debit side of the ledger, whereas it really belongs on the credit side, as one of the greatest assets and most profitable investments of many individual concerns and of whole industries. Another mistaken idea is that the cotton, wool and silk industries, being very old, have had ample time to solve their research problems. The truth is that ancient industries often have greater need for research than the newer ones." **Alban Eavenson** *in "Research—A Need of the Industry." Cotton, May 1938.*

Effect of Size and Size Application on the Properties of Continuous Filament Viscose Rayon

By WILLIAM E. YELLAND*

A Research of U. S. Institute for Textile Research

Summary

The operation of slashing is complex, involving a number of factors. These factors may be grouped roughly into two classes: (1) chemical, (2) physical or mechanical.

The chemical factors are those involving the nature of the sizing material and the softener used in the size mix. They are responsible for the stiffness and the cohesion of the sized warp yarns. These properties appear, in the cases studied so far, to be closely related. On the other hand, the mechanical factors are concerned with the mechanical abuse to which the yarn is subjected before and during slashing. They are mainly responsible for the residual elongation which the sized yarn possesses. Although the breaking strength of the yarn is usually increased by sizing, this increase in strength is not proportional to the amount of size on the yarn.

Introduction

SINCE the main purpose of sizing warp yarns is to impart to them certain properties which will allow them to be woven as efficiently as possible, the best way to test a sizing material is actually to weave the sized warp in the loom. This is an expensive and time-consuming process, but it is the only final and conclusive test of a sizing material. However, it is possible to evaluate a size approximately, and predict to a certain extent its behavior during weaving by comparing the properties of the yarn before and after the sizing or slashing operation. This report is based on a comparative study of the effects of various types of size on 150 denier 40 filament bright viscose rayon.

Unfortunately there is no apparatus for sizing in the laboratory which duplicates the mill process of slashing. Skein sizing ignores the effect of stretch, squeeze roll pressure and other mechanical treatment undergone by

* Dr. Yelland was director at Massachusetts Institute of Technology of the filament viscose rayon phase of the warp sizing research from Jan. 1, 1936 to Sept. 30, 1938.

the yarn in the mill. In an effort to reproduce mill conditions on laboratory scale the Shirley Institute in Great Britain has constructed an experimental slasher "which is not a scale model, but is virtually a longitudinal section of an industrial machine, the yarn being treated under conditions closely resembling those employed in technical practice" (F. D. Farrow and E. H. Jones, *J. T. I.*, *18*, T1–T23, 1927). Other machines have been devised for similar studies, but, as they are necessarily on a reduced scale, it is very doubtful whether they are able to duplicate satisfactorily the effect of the slasher on the yarn as regards stretch, speed, squeeze roll pressure, rate and temperature of drying.

In order to make this study as effective as possible it was decided that the yarn investigated should be taken from warps actually sized on slashers, under carefully controlled and recorded mill conditions. This avoids the possibility of introducing unknown variables which might enter from attempts to size on laboratory scale.

Among the yarn properties affected in the process of slashing are: (1) Load-extension properties; (2) stiffness; (3) cohesion.

Load-extension Properties

The strength and the residual elongation of a yarn at the breaking point may be determined readily by a Scott inclined plane serigraph. It is common knowledge that the elongation of sized, bright viscose rayon is considerably less than that of the unsized and that the breaking strength is usually greater. But it is not so well known that these properties—especially the residual elongation—are determined largely by the mechanical treatment of the yarn before and during slashing, and are but little affected by the amount or type of size on the yarn.

During slashing, no matter how the yarn is drawn through the quetsch, it is always subjected to more or less tension when wet. A certain minimum amount of tension is necessary to keep the ends parallel, so that they lie flat and do not lap over one another or "roll." Usually a greater tension than this is used so as to stretch the warp deliberately and increase the yardage. Under this tension the wet yarns elongate and are dried under tension in an extended state. It is this process which determines largely the load-extension properties of the sized yarn.

The effect of this on the yarn is illustrated by Fig. 1, Expt. I. The greater the stretch given the yarn in the wet condition the less elongation it has left after drying in the stretched condition, even after conditioning with the tension released. The breaking strength of the yarn is usually decreased by stretching in the wet condition and drying under tension.

Size apparently affects the stretch very little. This is shown by Expt. II, in which a warp was slashed under three different tensions with size mixes of similar composition but different concentrations. The type of size appears to have less effect than the wet stretch given the yarn during slashing, as is illustrated by Expt. III. In this experiment five different types of size were used, while the tension under which the warp was sized was kept constant. The sized yarn had approximately 7.4% less residual elongation than the original.

The breaking strength of the yarn may be increased anywhere from 6% to 14% by sizing, but this increase is not directly proportional to

the per cent size on the yarn, for a sample having less size may have a higher breaking strength than a more heavily sized sample. Marked differences in the type of size do not cause as great variations in the breaking strength as might be expected, the maximum increase in strength being 11.4%, the minimum increase in the same experiment being 6.4%.

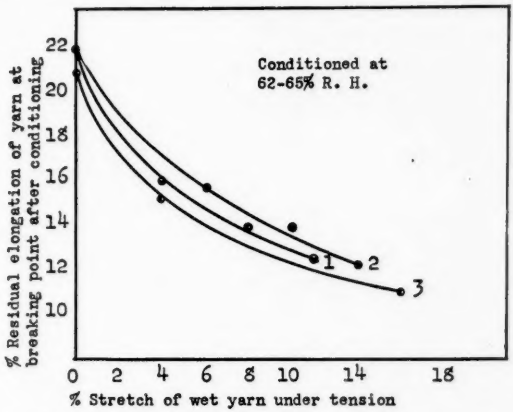

FIG. 1. Effect of stretching wet viscose and drying under tension.

Stiffness and "Cohesion"

These properties are much more affected by sizing than the load-extension properties, and, in the tests made so far they are affected in the same way, a yarn having a high cohesion value also having a high stiffness.

The stiffness of a yarn may be measured in a number of ways. In these experiments the force necessary to distort a loop through an angle from 0° to 90° was measured in milligrams. The loop was formed in a standard manner under the same tension each time. The apparatus will be described in greater detail later.

The "cohesion" of a size is its ability to hold the filaments together during weaving, and is its resistance to abrasion and repeated flexing. Comparative values may be obtained by means of a Duplan cohesion tester.

Both the cohesion and the stiffness are determined largely by the amount and type of size, and the softener present. The same sizing material when combined with different softeners gives entirely different results. For example, a starch-glycerine combination gives high cohesion and stiffness, while a starch-sulphonated olive oil combination produces much lower cohesion and less stiffness.

Cohesion is a desirable quality as it causes the warp to resist the abrasive action of the loom. On the other hand, excessive stiffness may be detrimental, causing "tear drops," etc. In order to work under opti-

mum conditions it may be necessary to sacrifice some cohesion in order to keep the stiffness at a minimum. It is obvious that conditions which are optimum for one mill may not be so for another, and a size mixture which works efficiently in one mill may be of little value in another due to an entirely different set of operating conditions and the constructions of fabric manufactured.

Experimental

Experiment I. Effect of Wet Stretch on the Elongation of Viscose. The yarn used was 150 denier 40 filament bright viscose. It was wet out, and samples were stretched 4, 8, 12, 14, 16% their length, fastened so that they could not contract and allowed to dry without contraction in an oven at 212° F. The tension was then released, and the yarn allowed to condition at approximately 70° F. and 65% R.H. During conditioning the yarn increased in length about 0.6%. Samples 10 in. in length were taken and the strength and elongation tested at the breaking point by means of a Scott inclined plane serigraph. The results tabulated are the averages of 10 determinations. They are summarized in Fig. 1.

Wet Stretch %	Residual Elongation at Breaking Point %	Breaking Load (grams)
0	22.3	300
4	16.1	270
8	14.0	268
12	12.6	278
1	22.0	312
6	15.8	302
10	14.0	308
14	12.2	306
0	20.8	301
4	15.4	283
8	14.0	295
16	11.1	305

All samples were conditioned at 62–65% R.H. after drying.

Experiment II. Effect of Size Concentration and Tension on Load-extension Properties of Sized Viscose. An experimental warp of 4,296 ends was sized on a 5-can slasher, using two concentrations of size, and three stretch settings on the slasher for each size mix. For the purpose of comparison a part of the warp was "slashed" at each stretch with water only in the size box at 140° F.—the sizing temperature employed in this series of experiments. To determine the actual stretch during the experiment, measured portions of the warp were marked off before slashing and the increase in length noted afterwards. After slashing the yarn was unwound from the dressed beam and conditioned at approximately 65% R.H. The elongation and breaking strength of 20 in. samples were determined on a Scott inclined plane serigraph. The results tabulated are averages of 20 determinations.

Size Mix	Concentration of Size	Concentration of Softener	Viscosity Relative to Water at 60° C.	pH
A	35 lb. per 100 gal.	10 lb. per 100 gal.	2.61	6.9
B	17.5 " " " "	12.5 " " " "	1.90	6.7

The size was a gelatin-dextrin in use commercially. The softener was sulphonated olive oil.

Mix	% Size on Yarn	% Wet Stretch on Slasher	% Residual Elongation	Breaking Load (grams)	R.H. %
A	5.4	6.2	14.6	297	66
B	3.9	6.4	13.7	288	63
Water	2.2	6.5	13.5	284	66
A	5.4	7.5	15.0	294	66
B	5.1	8.5	13.5	289	63
Water	2.2	10.0	12.7	281	66
A	5.4	14.4	9.9	302	66
B	4.3	16.9	9.6	302	63
Water	2.2*	14.4	9.2	287	66

* The percent size (2.2%) on the portions of the warp "slashed" with water, evidently came from the blanket on the squeeze roll.

Along with the above results, we may consider the effect of different amounts of a converted starch size with glycerine softener on 150 denier 48 filament viscose. The following samples were taken from warps sized on different slashers, and the stretch during slashing was approximately 5%.

% Size on Yarn	% Residual Elongation	Breaking Load (grams)
0.0	20.2	233
5.3	17.9	260
5.9	14.8	264
8.4	17.0	246

Experiment III. Effect of Different Types of Size on Load-extension Properties of Viscose. An experimental warp was sized with five different size mixtures under uniform tension.

Sample No.	Sizing Materials	Bloom	Viscosity
21	Chlorinated tapioca starch		
22	Blend {50% chlorinated tapioca, 50% edible gelatine}		
23	Gelatine—12% dextrine (approx.)		
24	Technical gelatine	110 grams	39 mlp.
25	Edible gelatine	250 grams	47.5 mlp.

	Moisture Content	Ash	pH	Grams water absorbed per gram of gelatine at 10° C.
23	14.1%	2.6%	6.7	9.0
24	11.4%	1.6%	6.9	14.0
25	11.8%	1.1%	6.5	13.5

Softeners used were glycerine and sulphonated olive oil.

Sample No.	Conc. in lbs. per 100 gal.	Softener	Conc. of softener in lbs./100 gal.	pH	Relative Viscosity
21	37.5	Glycerine	7.5	6.7	1.74
22	8.75 chlorinated tap 8.75 edible gelatine	"	3.5	6.6	1.44
23	17.5	Sulphonated olive oil	12.5	7.2	1.92
24	17.5	Sulphonated olive oil	12.5	7.0	2.35
25	17.5	Sulphonated olive oil	12.5	7.0	3.18

Preparation: The size was made up in 10 gal. quantities—sufficient to fill the size box. Size was weighed out and added with stirring to five gallons of cold water, and allowed to stand 10 minutes with occasional hand stirring. Steam was then passed in until 160° F. was reached for Samples 23, 24 and 25. It was necessary to pass in steam until temp. was 200° F. for 21 and 22. At this point the starch was quite soluble. The mixture was allowed to cool somewhat and the softener added. Cold water was added to make 10 gallons.

Application: The size was used within an hour of the time of preparation. Temperature of size box was 140° F. $\pm$ 5°. Slasher was set for 6% stretch.

Sample	% Size	% Residual Elongation	% Loss
20	0.0	20.8	0.0
21	5.4	13.3	7.5
22	4.4	12.6	8.1
23	5.6	13.2	7.6
24	3.4	13.9	6.8
25	4.1	13.7	7.1

These were made on the Scott serigraph and are the percent elongation obtained at the breaking point.

Sample	% Size	Breaking Load (grams)	Increase over unsized (grams)	% Increase
20	0.0	263	0.0	0.0
21	5.4	281	18	6.8%
22	4.4	280	17	6.4
23	5.6	287	24	9.1
24	3.4	292	29	11.4
25	4.1	284	21	8.0

Experiment IV. Effect of Different Types of Size on Stiffness and Cohesion. Samples of the yarn sized in Expt. III were tested for cohesion on a Duplan cohesion tester. The number of cycles which the yarn would stand before the filaments began to separate is taken as the cohesion number.

Sample	Average Cohesion Number
21	155
22	77
23	16
24	26
25	38

The stiffness of standard loops formed under uniform tension was measured and the results plotted in Fig. 2.

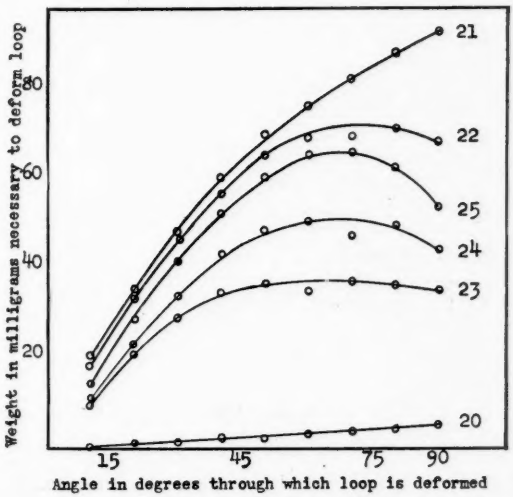

FIG. 2. Relative stiffness of sized viscose.

It will be noted that the samples (21 and 22) which show high cohesion are also the stiffest. Those samples had been sized with a converted starch, using glycerine softener. However, one must not infer from this that a starch size always gives high cohesion and stiffness, as data obtained from warps sized with starch using a sulphonated oil softener show much less cohesion and stiffness, so that the choice of a softener is fully as important as the choice of the size itself.

Must Make the Invisible Visible

THAT the devising of means of studying magnitudes too small to be examined in detail under the microscope and too large to be studied by X-rays, is an urgent problem, was pointed out by Sir William Bragg in an address on "The Grain-like Structure of Solids" to the Royal Society of Great Britain. "The microscope, he said, "reveals objects of diameter as small as a few hundred Å., but does not show the detail of such small objects. With X-rays, on the other hand, the crystalline arrangement of atoms and molecules can be accurately measured, but the details of larger structures are not revealed.

He noted that "Although it is said, by some, that a visible cellulose fibre is built up of fibrils which consist of ellipsoidal objects of dimensions roughly 1.5 μ and 1.1 μ and containing possibly many millions of cellulose chains, little is known of the structure of the contents or of the sheath that encloses them and is apparently the source of their characteristic influence. Information is also needed concerning the larger group and the fibril formation on which the fibre properties depend."

He also called attention to the fact that "The molecular weights of the proteins tend to group themselves about certain values simply related to each other, and this suggests that the molecules are built up according to certain rules, which are in force from the beginning to the completion of the assemblage."

When Research is Charity

"SOMEONE recently said, that pure research sometimes is brilliantly useless. I am reminded of a friend of mine, who likes gay parties in company of lady friends, and does quite some entertaining. The expenses thereby incurred he lists under the heading of 'charity.' How he gets away with it when making out his income tax return, I do not know.

"Research is 'charity' in a certain sense, because the other fellow, who does not contribute toward it, gets the benefit just the same.

"Snooping around in a competitor's mill or dye house to find out what he is doing, is not what I would call 'research'.

"Taking a microscope to determine the physical fundamentals of a fibre and its dynamic properties is real research.

"Just as it took years and years to find out what causes the knocking of the gasoline in the motor and to develop substances to prevent the knocking, so must we take advantage of the findings of pure research, analyze these findings and adapt them to the various phases of manufacturing, if we want to make advance.

"If you do not like the word 'research,' I have a substitute for it; the word is 'analysis,' and I believe in it 100%. Unlimited possibilities lie before us, if the textile chemist and the textile engineer work and analyze together."—A. W. Buhlmann in a paper presented to the annual meeting of A. A. T. C. C., Dec. 5, 1936.

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(*Continued from page 174.*)

don correspondent of the *Daily News Record* it is patented in this country and will be marketed here eventually. Fifty years ago this threatened exploitation of the domestic market could have been awaited with equanimity, for is it not a fact that more than a million laborers wore red flannel underwear as a protection against cold, heat and disease? Could a million Americans have been wrong? Red flannel was used to alleviate rheumatic pains, and when reinforced with a salt pork rind and red pepper was reputed to cure colds. Is research needed at this late date to confirm the virtues of the red flannel of our forefathers?

* * *

Casein fibre, made by the process developed and patented by Whittier and Gould of the Department of Agriculture, and dedicated to public use, has been subjected to various tests at the Bureau of Standards. The Washington correspondent of the *Daily News Record* reports these findings as follows: "Although the new chemically-made fibre would prove to be an extremely valuable substitute for wool in case of a shortage of the latter, it cannot be classed equally with wool in many ways. The fibre looks like wool and tests show that it takes dyes well. However, it does not wear well and is susceptible to bacteria. When in the process of deterioration, it emits a "barnyard" odor, according to testers. Also proven by tests is the fact that the fibre has not the strength or resilience of wool. It is thought that a mixture of good rayon staple fibre and wool would prove to be more satisfactory."

"*TO develop satisfactory methods to replace those which fail; to devise new techniques where none have previously existed; to supply exact knowledge of basic principles of fibre, yarn and fabric structure and behavior, fundamental research followed by application must be recognized as the answers.*"—**Prof. E. R. Schwarz.**

Abstracts

Committee on Abstracts and Bibliography:
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Address, C. H. Clark, Sec., 65 Franklin St., Boston, Mass.

I. Fibres (Synthetic and Natural) and Fibre Analysis

Acetylation of Cellulose in the Fibrous State by Two-Stage Pretreatment. M. Taniguchi and I. Sakurada. *J. Soc. Chem. Ind. (Japan)*, March 1938, V. 41, P. 71B–72B; abs. in *Eastman Kodak Abs. Bull.*, Oct. 1938. (S)

Cotton and Rayon: Effect of Purification Treatments on. Ruby K. Worner and Ralph T. Mease. *Ntl. B. S. J. Rsch.*, Nov. 1938, P. 609–16; RP1146.

This paper is concerned with the effect on cotton, and also on cuprammonium and nitrocellulose rayons, of the Corey and Gray modification of the American Chemical Society method for the preparation of "standard cellulose" from cotton. When the fibres were subjected to successive cycles of treatments, each of which consisted in separate extractions with alcohol, ether, and a 1% solution of sodium hydroxide, a progressive change in the fibres took place. This was evident from the loss of weight of the fibres and the increase in the fluidity of their cuprammonium solution. Low copper numbers were obtained for all the fibres after the first extraction with alkali. Repeated treatments had no pronounced effect on the alpha-cellulose content of the cotton. Alcohol and ether had no measurable effect other than the removal of soluble material during the first cycle. (C)

ISOELECTRIC POINT OF CELLULOSE: ADSORPTION AND SWELLING. J. Gavoret. *Comp. rend.*, May 2, 1938, V. 206, No. 18, P. 1299–3000; abs. in *Eastman Kodak Bull.*, Sept. 1938, P. 428.

By measuring the conductivities of buffer solutions alone and with a constant weight of purified cotton placed in a predetermined position between the two platinum electrodes, it has been possible to determine the isoelectric point of cotton by noting the maximum in the resistance-pH curve. This maximum occurs in the region pH = 2.4 to 2.8. This value is in accord with that which had been previously deduced from earlier results on the absorption of cellulose. This result helps to explain the known facts concerning the slight affinity of cellulose for the alkaline cations. (S)

STRUCTURE AND SOLUBILITY OF DENITRATED CELLULOSE NITRATES. M. Mathieu and T. Petitpas. *Comp. rend.*, May 16, 1938, V. 206, No. 20, P. 1485–86; abs. in *Eastman Kodak Abs. Bull.*, Oct. 1938. (S)

SULFITES: ACTION OF—ON THE CYSTINE DISULFIDE LINKAGES IN WOOL. INFLUENCE OF pH VALUE ON THE REACTION. F. F. Elsworth and H. Phillips. *Biochem. J.*, May 1938, V. 32, P. 837–43; abs. in *Eastman Kodak Abs. Bull.*, Oct. 1938.

It is shown that the disulfide linkages of wool react with sodium bisulfite solutions at ordinary temperatures to form thiol and S-cysteine-sulfonate side-chains. The S-cysteine-sulfonate side-chains decompose when the sulfited wool is heated with water, either thiol groups and bisulfate, or sulfenic acid groups and bisulfite being produced, depending on the acidity of the water. The presence of thiol groups in sulfited wool which has been brought to equilibrium with water at a pH value of 5 increases the alkali-combining power of the wool. The mechanism of the reaction between the disulfide linkages of wool and sodium bisulfite is discussed. (S)

X-RAY DIFFRACTION ANALYSIS AND ITS APPLICATION TO THE STUDY OF PLANT CONSTITUENTS. Wayne A. Sisson. *Contrib. Boyce Thompson Inst.*, 1938, V. 9, No. 5, P. 381–95.

With the use of X-ray diffraction analysis the presence of amorphous material and the identity of several crystalline materials are demonstrated in the young cotton fibre. The limitations of qualitative and quantitative X-ray analysis are discussed and illustrated in the detection of cellulose in lignin and at the early stages of cotton fibre growth. The development of orientation in the growing fibre is followed, and the X-ray orientation compared with the microscopic structure. X-ray possibilities in the determination of crystal structure, the study of chemical reactions, and the phenomenon of swelling are briefly pointed out. The limitations and possible correlations of X-ray with microscopic data are illustrated with applications to *Halicystis*. (C)

X-RAY DIFFRACTION STUDIES: ORIENTATION IN YOUNG COTTON FIBRES AS INDICATED BY. Wayne A. Sisson. *Contrib. Boyce Thompson Inst.*, 1938, V. 9, No. 3, P. 239–48.

Cotton fibres of three varieties at various stages of growth were examined by X-ray diffraction methods to determine (a) the degree and type

of orientation at various periods of cell wall development; (b) the orientation of noncellulosic constituents present; (c) the production of artificial orientation by stretching; and (d) the relative orientation of different varieties. The following conclusion may have practical value: Drying under tension improves the orientation of fibres showing a preferred orientation, while those showing a random orientation are not appreciably affected. Films and fibres prepared under tension from purified cellulose show a preferred orientation in all samples, regardless of the age of the fibres from which the cellulose was obtained. (C)

II. Yarns and Fabrics

"Nylon" Selected as Name for First All-Chemical Yarn. *Rayon Tex. Mo.*, Nov. 1938, P. 30.

Brief and incomplete description of the new nylon yarn of E. I. du Pont de Nemours & Co., as given in an address by Vice-Pres. Charles M. A. Stine, at the *Herald-Tribune* Forum, Oct. 27. (C)

Practical Handling of Staple Fibre on Cotton Machinery. *Rayon Tex. Mo.*, Sept. 1938, P. 91–2. (C)

Processing Wool. E. W. Pierce. *Canadian Text. J.*, Sept. 30, 1938, P. 29–32.

Summary of a paper presented at the 1938 Summer School of the Canadian Association of Textile Colorists and Chemists. It relates to modern methods and equipment to produce quality merchandise, and includes observations on general dyehouse practice. (C)

Rayon Industry: Recent Developments in the. B. L. Hathorne. *Am. Dye. Rptr.*, Nov. 29, 1938, P. 686–7.

New filament and spun rayons of domestic and foreign manufacture are discussed. (C)

Rayon Staple Fibres: Manufacture and Conversion of. F. Bonnet. *Rayon Tex. Mo.*, Nov. 1938, P. 55–8.

Paper presented at the 1938 Fall Meeting of A. S. T. M. The author has laid down in this paper the present facts about the manufacture of rayon staple fibre and the use of same in the making of spun rayon yarns. He also touches upon related fibres not generally classified as rayon. (C)

Silk-screen Printing. F. W. Mackenzie. *J. Soc. Dyers and Colourists*, May 1938, V. 54, P. 196–201; abs. in *Eastman Kodak Abs. Bull.*, Oct. 1938.

The history of various processes employing stencils for the reproduction of designs, leading up to the introduction of the Selectasine Silk-Screen printing process, is traced and a large number of applications of the method are detailed. The latter include printing on wood, tin, glass, paper, leather, and textiles. The materials used as screens range from organdie to flat-rolled wire mesh, but silk bolting cloth is stated to be specially suitable. The stencils may be hand-cut paper stencils or may be photomechanically

produced by means of carbon tissue. "Profilm" is stated to represent the greatest advance in cut stencils. Profilm consists of a cellulose acetate film coated with plasticized shellac which is supported on a backing sheet of glazed transparent paper by means of a gutta-percha coating. The Profilm is affixed to the design to be reproduced and the necessary color spaces are scored with a stencil knife through the top film only, the unwanted portions being stripped away. The stencil is subsequently ironed on to the screen which, on peeling off the backing paper, is ready for printing. Details of the working of the silk-screen process are described. (S)

SPINNING STAPLE FIBRE ON THE WORSTED SYSTEM. George F. Bliss. *Rayon Tex. Mo.*, Nov. 1938, P. 59–61.

Abstract of a paper presented at the A. S. M. E. 1938 Fall Meeting. (C)

STAPLE FIBRE: PRESENT STATUS OF. J. B. Quig. *Rayon Tex. Mo.*, Sept. 1938, P. 64–5.

"Dr. Quig points out the present status of staple manufacture, its use on cotton machinery and problems connected with it, as well as the progress that has been made in finishing and with blends of other fibres such as flax and wool. He would like to see rayon staple fibre stand on its own merits and not as a substitute or diluent only." (C)

STAPLE FIBRES IN CARPETS AND RUGS: PROGRESS IN USE OF. G. E. Hopkins. *Rayon Tex. Mo.*, Sept. 1938, P. 97–9; Oct., P. 62–3. (C)

STARCH IN TEXTILES: ROLE OF. James W. Stallings. *Am. Dye. Rptr.*, Nov. 28, 1938, P. 704.

Abstract of paper presented at Technical Session of Atlanta, Ga., meeting of A. A. T. C. C., describing starches and starch products, and their proper selection and application in finishing and printing. (C)

TESTING THE QUALITY OF SPUN RAYON FABRICS. Alex. Sommaripa. *Rayon Tex. Mo.*, 1938, Nov., P. 69–71; Dec., P. 62–4.

Paper presented at the 1938 Fall Meeting of A. S. T. M. (C)

TEXTILE WASTE STUDIES IN NORTH CAROLINA. Henry J. Miles and Ralph Porges. *Am. Dye. Rptr.*, Dec. 12, 1938, P. 736–42.

An outline of the problems of textile waste disposal, and a practical review of the research project conducted at the University of North Carolina and at a pilot plant in Greensboro, N. C., and financed by The Textile Foundation. All progress reports to date of this research have been published in *Tex. Rsch.* (C)

TEXTILES: AIR-DRYING. A. Rossie. *Monatsh. Seide u. Kunstseide*, 1937, V. 42, P. 423–7; abs. in *J. T. I.*, July 1938, P. A407.

A general discussion of the factors involved in the drying of textiles by air, under the following headings: (1) Temperature of the material (*a*) in the "wet" region where it is constant, and (*b*) in the "hygroscopic" region where it rises rapidly, the "hygroscopic" point being the point at

which the material is no longer "wet" but its vapor pressure (p) is equal to the saturated vapor pressure of air (P) at the particular temperature. (2) The course of drying in the "hygroscopic" region; relation of p/P to moisture regain. (4) Control of drying. (C)

TIRE CORD: NEW HIGH-DENSITY. J. Brandwood. *Text. Recdr.*, Oct. 6, 1938, P. 109.

The Brandwood patent tire cord is a development of the Brandwood twistless and low-density cotton yarns, the individual fibres of which are impregnated to prevent fibre-on-fibre slippage and to increase their strength. Claims as to its properties and advantages are given, but nothing is said as to results in commercial use. (C)

WARP-WADDED FABRICS. R. A. C. Scott. *Text. Wld.*, 1938, June, P. 58; Oct., P. 66.

General principles underlying the construction of wadded double cloths, the method by which they make possible production of fabrics of increased weight but unaltered face and back textures, and specific instructions for designing filling-wadded fabrics. (C)

III. CHEMICAL AND OTHER PROCESSING (NOT OTHERWISE CLASSIFIED)

DYEING: MODERN METHODS OF. Edward W. Pierce. *Cotton*, Dec. 1938, P. 48–51.

The first of a series of articles on dyeing methods, materials and applications the treatment of which is sufficiently broad to be of value to designers, purchasing agents, mill executives and superintendents, as well as to dyers and finishers. This first article treats of development of the color sense. (C)

DYEING OF NAPHTOLS ON COTTON PIECE GOODS BY CONTINUOUS HOT FLUE METHOD. S. H. Williams. *Am. Dye. Rptr.*, Nov. 28, 1938, P. 704.

Abstract of paper presented at Technical Session of Atlanta, Ga. meeting of A. A. T. C. C. (C)

DYEING OF WOOL WITH ACID DYES. R. O. Hall. *J. Soc. Dyers Col.*, 1938, V. 54, P. 172–3; abs. in *J. T. I.*, July 1938, P. A409.

In the normal process of dyeing wool with acid dyes the main function both of heat and of acid is to decompose ammonium salt linkages and to separate the peptide chains within the micelles. Since this function can be performed by cold formic and acetic acids of suitable concentration, it should be possible to dye wool in cold solutions of these acids as effectively as in the boiling or nearly boiling solution of normal dyehouse practice. Experiments demonstrating this possibility are described. (C)

ETHANOLAMINES: APPLICATION. G. Cerisy. *Tiba*, 1938, V. 16, P. 183–91; abs. in *J. T. I.*, July 1938, P. A407.

A general account is given of the preparation and properties of ethanolamines, the preparation of triethanolamine soaps, the use of these soaps in the preparation of emulsions, and the use of triethanolamine and

emulsions prepared with triethanolamine soaps in washing, oiling, sizing, dyeing and printing processes. (C)

HYDROCELLULOSE AND OXYCELLULOSE: CHEMISTRY OF. Charles Goldthwait. *Am. Dye. Rptr.*, Nov. 28, 1938, P. 692–4.

The author reviews the published work on the subject of Davidson (*J. T. I.*, *27*, P159; *Ibid.*, *29*, T215) and of Doree and Healey (*J. T. I.*, *29*, T215) and concludes as follows: "Although we may have thought of the oxycellulose and hydrocellulose reactions merely as something that spoils the cotton (or rather cellulose), it has become clear through continued research that they are the results of definite chemical reactions although our knowledge about them is still more or less indefinite." (C)

MODERN PACKAGE DYEING EQUIPMENT. Thos. R. Smith. *Am. Dye. Rptr.*, Nov. 28, 1938, P. 704.

A description of up-to-date package dyeing equipment for cotton yarn, both mercerized and unmercerized, and the important features of the machinery which must be considered to insure efficient operation and a superior quality of dyeing. (C)

PLEXTOL: APPLICATION IN FINISHING. K. Walter. *Mell. Textilber.*, German Ed., 1938, No. 4, P. 376–9; abs. in *J. T. I.*, July 1938, P. A412.

Plextol D1, D2 and D89 are aqueous dispersions of Plexigums and are used for the production on textile materials of finishes that are fast to washing. Samples of a printed staple fibre fabric in the unfinished, Plextol finished, and finished and washed states are given and discussed, and the advantages of Plextol finishes are pointed out. (C)

PRINTING WITH PIGMENTS: SOME FUNDAMENTAL DIFFERENCES IN. Henry L. Young. *Am. Dye. Rptr.*, Nov. 28, 1938, P. 703.

Abstract of paper presented at Technical Session of Atlanta, Ga. meeting of A. A. T. C. C., discussing the economic and technical advantages of pigment (aridye) printing. (C)

RAYON STAPLE FIBRE: MERCERIZATION. Russina. *Monatsh. Seide u. Kunstseide*, 1938, V. 43, P. 136–38; abs. in *J. T. I.*, July 1938, P. A407.

The effects of mercerization on cotton and on staple fibre are compared and it is pointed out that the X-ray diagram of unmercerized staple fibre corresponds to that of mercerized cotton and that the loosening up of the crystallites in staple fibre is further advanced than in mercerized cotton, which accounts for the greater reactivity of the former. It is suggested that improvements in the properties of staple fibre would be effected by reducing the loosening of the crystallites. The results of strength tests and a load-extension diagram showing the effects of mercerization with caustic soda, caustic soda-caustic potash, and caustic potash on staple fibre yarn are given and discussed. None of the treatments produced any increase in strength of the yarn in the dry state though a slight increase in wet strength was produced by the caustic potash treatment. The load-extension diagram shows practically no difference between the unmercerized yarn and that mercerized with caustic soda, with or without salt additions, but improved elasticity is observed in yarn mercerized with caustic potash or with a mixture of this with caustic soda. (C)

IV. Research Methods and Apparatus

Color: Objective Measurement of. J. W. Perry. *J. Sci. Instruments*, August, 1938, V. 15, P. 270–77; abs. in *Eastman Kodak Abs. Bull.*, Oct. 1938.

An instrument for the determination of trichromatic color specifications, using filter-screened photocells, is described. The sample and standard are placed successively in the beam, and equal deflections are obtained by passing the light through an adjustable wedge before it is incident on the standard. The calibration is thus independent of any assumption of proportional response of the photocell. The errors due to incorrect filters are analyzed theoretically. Since the magnitude of these errors decreases when the sample and standard have more closely similar spectrophotometric curves, the instrument is primarily recommended for measurements of series of spectrophotometrically similar samples, such as near-whites. The accuracy obtainable for the I. C. I. trichromatic co-ordinate is said to be ± 0.002 when the sample co-ordinates do not differ from the co-ordinate of the standard by more than ± 0.10. The accuracy of brightness measurements is said to be $\pm 0.3\%$. (S)

Color Measurement: New Apparatus for. M. Richter. *Z. tech. Physik*, 1938, V. 19, No. 4, P. 98–103; abs. in *Eastman Kodak Bull.*, Sept. 1938, P. 421.

A trichromatic colorimeter is described, in which light beams from two highly saturated filters, selected out of a set of eight designed to cover the entire hue range, are mixed with white light in an integrating sphere. The intensities of all three of these constituents can be varied at will. White light can be eliminated from the trichromatic mixture, and introduced into the sample beam in a continuous transition, which is said to be a favorable condition for the accurate measurement of highly saturated colors. The two colored filters are chosen such that the hue of the sample can be produced by an intermediate mixture. The advantages claimed for this method are: (1) The spectral distributions in the sample and the synthesized beams are nearly alike, minimizing the effects of anomalies of color vision. (2) Very small amounts of constituents can be avoided by proper choice of the constituent colors, thus eliminating the danger of large relative errors. (3) Color tolerance filters can be placed directly in the instrument and the colors of samples compared directly with the acceptable color limits. The accuracy and ease of measurement are said to be superior to that of any conventional trichromatic colorimeter in which three fixed chromaticities are used for all measurements. (S)

Histidine: Simplified Method of Preparing. L. E. Gilson. *J. Biol. Chem.*, June 1938, V. 124, P. 281–85; abs. in *Eastman Kodak Abs. Bull.*, Oct. 1938.

A much simplified modification of Hanke and Koessler's procedure for the preparation of histidine is described. A blood protein hydrolyzate is used as the source of the amino acid which is isolated as a mercuric chloride complex. A method of removing iron from the solution is described, and crystallization of the pure histidine-dihydrochloride from dioxane-water is carried out. (S)

LOW-VOLTAGE FLUORESCENT LAMPS. G. E. Inman and R. N. Thayer. *Elec. Engineering*, June 1938, V. 57, P. 245–8; abs. in *Eastman Kodak Bull.*, Sept. 1938, P. 420.

Long tubular-shaped lamps are given an inside coating of a fluorescent material which is energized by a hot-cathode positive-column electric discharge. Visible radiation thus produced can have either a daylight quality or a specified color by proper choice of the fluorescing material. The lamps possess high efficiency, low surface brightness, and reduced glare. A faint mercury spectrum is present. Their life is expected to be longer than that of filament-type lamps, but their lumen maintenance will be comparable with that of filament lamps of the vacuum type. Design features and the circuits employed are explained. (S)

OPTICAL PROJECTION: POSSIBILITIES AND LIMITATIONS IN INDUSTRY. H. F. Kurtz. *Mechanical Engineering*, June 1938, V. 60, P. 469–73; abs. in *Eastman Kodak Bull.*, Sept. 1938, P. 420.

Details are given of a basic ideal system of optical projection of machine parts which are to be measured or compared precisely, and an instrument is described which practically approaches the basic ideal. (S)

TENSILE STRENGTH OF FLAX YARN: DETERMINATION OF. Hans Biczysko. *Mell. Textilber.*, German Ed., 1938, No. 12, P. 964–66.

Two irregularities must be taken into consideration when calculating the tensile strength of a given yarn, one being the lack of uniformity of the raw material, and the other the irregularities that occur during manufacture. The question accordingly arises as to how many consecutive breaking tests are required in order to determine the mean tensile strength of part of a yarn, and further as to how many groups of tests are required in order to determine the mean tensile strength of a considerable length of yarn. For that purpose the author has developed the following formula

$$n = \frac{P_n - P_n + 1}{b} - 1,$$

in which P represents the individual breaking forces, n the number of breaking tests required, and b the permissible deviation of the mean. The way in which the formula can be used is demonstrated by means of a number of practical tensile strength tests. (C)

TESTING HOSIERY: METHODS OF. E. Max Schenke and Howard E. Shearer. Ntl. Bureau of Standards Circular No. C422, Oct. 11, 1938, 34 pages.

The object of a laboratory analysis of hosiery may be to provide data for a calculation of the cost of production, or to make possible the exact reproduction of hosiery. Often it is to determine the differences between two stockings, to relate defects to variations in yarns or construction, or to compare the service qualities of one stocking with another. The procedures used by the research associateship of the National Association of Hosiery Manufacturers at the National Bureau of Standards, and by others, are described in this publication for the information of manufacturers, commercial testing laboratories, home economics teachers, and distributors of hosiery. (C)

V. Economic Research and Miscellany

Aging Process of Alcohol-acetone Solutions of Cellulose Nitrate. I. O. Goldman. *Kino Photo Chem. Ind.*, 1938, No. 3, P. 30–5; abs. in *Eastman Kodak Abs. Bull.*, Oct. 1938.

Pure acetone solutions of cellulose nitrate show the greatest drop of viscosity in aging. This drop slows down, as the concentration of the solution increases, beginning especially at 16%. The greatest drop in viscosity is noticed after eight days, when it gradually slows down and finally ceases entirely. The aging process is retarded by adding more than 50% alcohol to the acetone. The mechanical properties of cellulose nitrate do not seem to suffer noticeably in spite of the pronounced drop in viscosity. The addition of ammonia to an alcohol-acetone solution of cellulose nitrate hardly affects the properties of the film. Regardless of the drop in viscosity in aging, the mechanical properties are not only not adversely affected, but the elasticity is actually improved. Since the acetone contains resinous admixtures, the film turns slightly yellow on the addition of ammonia. Evidently, the presence of ammonia intensifies the process of resinification. The author believes that the fact that the viscosity of cellulose nitrate solution is reduced without harming the mechanical properties of the film by the addition of ammonia is noteworthy. The question must be studied much more thoroughly, however, before a definite opinion can be given. (S)

Amino Acids: Quantitative Determination of. W. H. Stein, C. Niemann, and M. Bergmann. *J. Amer. Chem. Soc.*, July 1938, V. 60, P. 1703–04; abs. in *Eastman Kodak Abs. Bull.*, Oct. 1938.

A method of estimating the amounts of an amino acid present in a mixture of substances is described The method is based on a series of incomplete precipitations with a precipitant which is specific for the desired amino acid. This is offered as an alternate procedure to those types of analytical precipitation which aim for 100% isolation of the substance as its derivative. The procedure has been applied to proline precipitated by rhodanilic acid, glycine, alanine, and leucine by dioxpuridic acid, and to tyrosine precipitated by dioxanilic acid. (S)

Crystal Structure of Cellulose and Rubber. H. Mark and K. H. Meyer. *Z. physikal. Chem.*, 1938, V. 38B, No. 6, P. 395–99; abs. in *Eastman Kodak Abs. Bull.*, Oct. 1938.

Sauter's structural interpretation of the X-ray diffraction evidence for cellulose and rubber is denied on technical grounds. (S)

Electron Diffraction Methods of Studying Organic Films. L. H. Germer. *J. Appl. Physics*, March 1938, Vol. 9, P. 143–47; abs. in *Eastman Kodak Abs. Bull.*, October 1938.

The experimental technique applied to the study of one or more molecular layers of organic materials by the method of electron diffraction is described, and some results on substances, such as polyethylene-sebacate and gutta-percha, are given. It is pointed out that the method is not free from difficulty either in the development of the proper technique or in the interpretation of the diffraction pattern obtained. (S)